

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY


(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 20 DEC 2005

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Applicant's or agent's file reference P 03 050 WO		<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/DK2003/000613		International filing date (day/month/year) 22.09.2003		Priority date (day/month/year) 22.09.2003
International Patent Classification (IPC) or national classification and IPC H03M1/12				
Applicant TC ELECTRONIC AS ET AL.				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> sent to the applicant and to the International Bureau) a total of sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input checked="" type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand  07.04.2005		Date of completion of this report  19.12.2005		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer Beindorff, W Telephone No. +31 70 340-2273		



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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-26 as originally filed

**Claims, Numbers**

1-24 as originally filed

**Drawings, Sheets**

1/18-19/18 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

~~-----\*If item 4 applies, some or all of these sheets may be marked "superseded."~~

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	1-20,22-24
	No: Claims	21
Inventive step (IS)	Yes: Claims	1-20,22-24
	No: Claims	21
Industrial applicability (IA)	Yes: Claims	1-24
	No: Claims	none

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

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**Box No. VII Certain defects in the international application**

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The following defects in the form or contents of the international application have been noted:

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Re Item V.**

1 The following documents are referred to in this communication:

D1 : SABOURI F ET AL: "A HIGH-PERFORMANCE CALIBRATION-FREE CHARGE-BALANCING ANALOG-TO-DIGITAL CONVERTER" IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, IEEE INC. NEW YORK, US, vol. 45, no. 5, October 1996 (1996-10), pages 847-853, XP000631687 ISSN: 0018-9456 (introduced by the IPEA under Rule 70.7(a) PCT)

**2 Independent claim 1**

- 2.1 Document D1, which is considered to constitute closer prior art than the documents cited in the International Search Report, discloses (see figures 1-3 and page 847, col. 2, line 25, to page 848, col. 1, line 11) an A/D converter (fig. 1) comprising a [charge-balancing]<sup>1</sup> modulator (fig. 1 and 2), said converter comprising [a] loop comprising at least one forward path (from  $V_i$  to  $V_o$ ) and at least one feedback path (from  $V_o$  to  $V_i$  via  $R_1$ ), wherein the at least one forward path comprises amplitude quantizing means (the opamp having  $V_{th}$  at its inverting input) combined with time quantizing means (the D-flipflops) and outputting at least one time and amplitude quantized signal ( $V_o$ ).
- 2.2 From this, the subject-matter of independent claim 1 differs in that according to claim 1 the modulator is a self-oscillating modulator and the A/D converter comprises at least one self-oscillating loop.
- 2.3 The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).
- 2.4 The problem to be solved by the present invention may therefore be regarded as how to improve the accuracy of the time quantizing in a given frequency band compared to what should be expected based on the known properties of an available time quantizer. (See page 2, lines 17-19, of the description.)
- 2.5 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:  
The problem is not addressed by D1, neither does it provide any indication why the skilled person would have reasons to replace the charge-balancing modulator by a self-oscillating

<sup>1</sup>

For a better readability of this description features which are not in common with the application but form part of the solution provided by D1 are inserted in square brackets among the features which are in common.

one.

**3 Dependent claims 2-20**

Claims 2-20 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**4 Independent claim 21**

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 21 is not new in the sense of Article 33(2) PCT.

Document D1 discloses (see figures 2-3 and page 847, col. 2, line 25, to page 848, col. 1, line 11) a method of performing an A/D conversion comprising the steps of representing a pulse-width modulated representation as an analogue signal ( $V_{\text{comp}}$ ) and quantizing (by the two flip-flops) the pulse-width modulation in the time domain.

**5 Dependent claims 22-24**

5.1 The subject-matter of dependent claim 22 corresponds in terms of method features to that of independent claim 1. Thus, for the same reasons as set out in section 2 above, claim 22 is considered to be novel and to involve an inventive step.

5.2 Claims 23-24 are dependent on claim 22 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**6 Further comments**

**6.1 Documents cited in the international search report**

US-A-5204635 discloses an A/D converter forming part of a digital FM demodulator in which the instantaneous frequency is converted to a discrete pulse-width modulated signal using a phase detector, the output of which is subsequently amplitude and time quantised by a comparator and a clocked D-flip-flop.

DE-A-3642360 describes an A/D converter for synchronous sampling of periodical signals in which the starting time for the sampling cycles is shifted in time for minimising phase jumps. WO-A-02/25357 describes a self-oscillating modulator per se, without mentioning any application to an A/D converter.

None of these documents either addresses the problem or provides any indication as to its solution.

**6.2 Further documents cited in the description**

The documents cited at page 9 of the description all describe self-oscillating modulators per

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se, without mentioning any application to an A/D converter either.

**6.3 Related priority application PCT/DK04/000643**

For the case that both this and copending application PCT/DK04/000643 are prosecuted in any national or regional phase it is noted that their sets of claims partially overlap.

**Re Item VII.**

The following is noted with respect to the description and the claims:

- 1 Independent claims 1 and 21 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(I) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).
- 2 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
- 3 The *incorporation by reference* of the prior art documents at pages 9 and 10 of the description does not meet the requirements of Art. 5 PCT, see the PCT Guidelines, section 4.26.
- 4 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1 is not mentioned in the description, nor is this document identified therein.

**Re Item VIII.**

The following is noted with respect to clarity (Art. 6 PCT):

- 1 The term "amplitude time quantizing means" in claims 9 and 10 (and also at page 4, lines 13 and 16, of the description) is not defined in any claim to which these claims refer or in the description, neither is it clear by itself. It should probably read "amplitude **and** time quantizing means".
- 2 Claim 10 refers to any of claims 1-9 but should probably refer to any of claims 1-8 only, as the additional features of claims 9 and 10 appear to be mutually exclusive (the term "multi-level" generally being interpreted in the art as meaning "at least three levels").

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- 3 In claim 19 the characterizing feature "... wherein a variable delay in the feedback path." is apparently incomplete.
- 4 Neither in claim 20 itself, nor in anyone of the claims on which it depends, is defined what is switched by "the switch frequency" mentioned in claim 20.